

ABSTRACT

A method and apparatus for increasing the quantum efficiency of a photomultiplier tube by providing a photocathode with an increased surface-to-volume ratio. The photocathode includes a transparent substrate, upon one major side of which is formed one or more large aspect-ratio structures, such as needles, cones, fibers, prisms, or pyramids. The large aspect-ratio structures are at least partially composed of a photoelectron emitting material, i.e., a material that emits a photoelectron upon absorption of an optical photon. The large aspect-ratio structures may be substantially composed of the photoelectron emitting material (i.e., formed as such upon the surface of a relatively flat substrate) or be only partially composed of a photoelectron emitting material (i.e., the photoelectron emitting material is coated over large aspect-ratio structures formed from the substrate material itself.) The large aspect-ratio nature of the photocathode surface allows for an effective increase in the thickness of the photocathode relative the absorption of optical photons, thereby increasing the absorption rate of incident photons, without substantially increasing the effective thickness of the photocathode relative the escape incidence of the photoelectrons.